WHAT IS CLAIMED IS:

1.   ~~A coordinates correction apparatus comprising:~~

a coordinates reception means for receiving

coordinates from a coordinates input means of locations

5   optionally indicated on a coordinates input area of the

coordinates input means;

a parameter keeping means for keeping quadratic

nonlinear conversion constants as coordinates

correction parameters for correction of the coordinates

10   received by the coordinates reception means; and

a coordinates correction means for correcting the

coordinates received by the coordinates reception means

by quadratic nonlinear conversion using the coordinates

correction parameters kept by the coordinates keeping

15   means.

2.   The coordinates correction apparatus of Claim

1, wherein the coordinates correction parameters of the

parameter keeping means are a, b, c, d, e, f, g, and h

20   and the quadratic nonlinear conversion for correcting

the coordinates (x, y) received by the coordinates

reception means to corrected coordinates (X, Y) is

expressed by:

$$X = axy + bx + cy + d$$

25   ~~$Y = exy + fx + gy + h.$~~

3.   The coordinates correction apparatus of Claim

1, further comprising a coordinates input means.

4. The coordinates correction apparatus of Claim
1, further comprising a coordinates output means for
outputting the coordinates corrected by the coordinates
correction means.

5. The coordinates correction apparatus of Claim
1, further comprising a parameter calculation means for
calculating the coordinates correction parameters for
nonlinear conversion and keeping the nonlinear
conversion coordinates correction parameters by the
parameter keeping means.

6. The coordinates correction apparatus of Claim
5, wherein the parameter calculation means calculates
the coordinates correction parameters based on the
coordinates of locations indicating multiple reference
points established on the coordinates input area.

7. The coordinates correction apparatus of Claim
6, wherein the parameter calculation means further
comprises a discrimination means for discriminating
which of the multiple reference points indicated
corresponds to the coordinates of an indicated
location.

8.   The coordinates correction apparatus of Claim 6, wherein the parameter calculation means calculates coordinates correction parameters by solving simultaneous equations based on the indicated

5   coordinates corresponding to the multiple reference points.

9.   The coordinates correction apparatus of Claim 6, wherein the multiple reference points are displayed

10   by a liquid crystal display.

10.   The coordinates correction apparatus of Claim 6, wherein four designated coordinates expressed in pairs of two x coordinates and two y coordinates are

15   used as the multiple reference points if the coordinates system on the coordinates input area is a coordinates system expressed in an xy rectangular coordinates system.

20   11.   The coordinates correction apparatus of Claim 10, wherein the parameter calculation means calculates the coordinates correction parameters a, b, c, d, e, f, g, and h by solving the following formulas where the coordinates of the four reference points as (X_0, Y_0),

25   (X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates of the pointed locations with aiming at points as (x_{nw}, y_{nw}), (x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, y_{se});

$$X_0 = ax_{nw}y_{nw} + bx_{nw} + cy_{nw} + d$$

$$Y_0 = ex_{nw}y_{nw} + fx_{nw} + gy_{nw} + h$$

$$X_1 = ax_{ne}y_{ne} + bx_{ne} + cy_{ne} + d$$

$$Y_0 = ex_{ne}y_{ne} + fx_{ne} + gy_{ne} + h$$

$$X_0 = ax_{sw}y_{sw} + bx_{sw} + cy_{sw} + d$$

$$Y_1 = ex_{sw}y_{sw} + fx_{sw} + gy_{sw} + h$$

$$X_1 = ax_{se}y_{se} + bx_{se} + cy_{se} + d$$

$$Y_1 = ex_{se}y_{se} + fx_{se} + gy_{se} + h$$

the parameter keeping means keeps the coordinates correction parameters; and

the coordinates correction means corrects the coordinates (x, y) received from the coordinates reception means to corrected coordinates (X, Y) by the quadratic nonlinear conversion:

$$X = axy + bx + cy + d$$

$$Y = exy + fx + gy + h.$$

12. The coordinates correction apparatus of Claim 5, further comprising a switching means for causing the correction of coordinates by the coordinates correction means if coordinates correction parameters are kept by the parameter keeping means or causing the calculation of coordinates correction parameters by the parameter calculation means if coordinates correction parameters are not held by the parameter keeping means when the coordinates reception means receives indicated

-coordinates.

13. The coordinates correction apparatus of
Claims 1 to 12, wherein the coordinates correction
5   apparatus is a portable information processing
apparatus.

14. The coordinates correction apparatus of
a · Claims 1 to 13, wherein the coordinates correction
10   apparatus can be connected to a network.

15. A coordinates correction parameter
calculation apparatus for calculating coordinates
correction parameters for coordinates correction of
15   locations arbitrarily pointed to in a coordinates input
area included in a coordinates input apparatus by
nonlinear conversion, comprising:

a coordinates reception means for receiving
coordinates of locations pointed to with aiming at
20   multiple reference points set at different locations in
the coordinates input area from the coordinates input
apparatus; and

a parameter calculation means for calculating
nonlinear formula coordinates correction parameters for
25   coordinates correction by solving simultaneous
equations established by substituting the coordinates
received by the coordinates reception means in the

nonlinear equations for coordinates correction.

16. The coordinates correction parameter calculation apparatus of Claim 15, further comprising a parameter output means for outputting the coordinates correction parameters calculated by the parameter calculation means to an external device.

17. The coordinates correction parameter calculation apparatus of Claim 16, wherein the parameter output means is a device for writing the coordinates correction parameters calculated by the parameter calculation means onto a memory medium.

18. The coordinates correction parameter calculation apparatus of Claim 17, wherein the parameter output means is a ROM writer for writing the coordinates correction parameters calculated by the parameter calculation means onto a ROM.

19. The coordinates correction parameter calculation apparatus of Claim 15, wherein the parameter calculation means further comprises a discrimination means for discriminating which of the multiple reference points corresponds to the coordinates of the indicated location.

20. The coordinates correction parameter
calculation apparatus of Claim 15, wherein four
designated coordinates expressed in pairs of two x
coordinates and two y coordinates are used as the

5 multiple reference points in the case that the
coordinate input area is expressed in an xy rectangular
coordinates system.

21. The coordinates correction parameter

10 calculation apparatus of Claim 20, wherein the
parameter calculation means calculates the coordinates
correction parameters a, b, c, d, e, f, g, and h, when
the nonlinear equations for coordinates correction for
correcting the coordinates (x, y) received from the

15 coordinates reception means to the corrected
coordinates (X, Y) are expressed by the quadratic
nonlinear equations represented by

$$X = axy + bx + cy + d$$
$$Y = exy + fx + gy + h,$$

20 by solving the following formulas where the coordinates
of the four reference points as (X_0, Y_0), (X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates of the
pointed locations with aiming at points as (x_{nw}, y_{nw}),
(x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, y_{se}):

25

$$X_0 = ax_{nw}y_{nw} + bx_{nw} + cy_{nw} + d$$

$$Y_0 = ex_{nw}y_{nw} + fx_{nw} + gy_{nw} + h$$

$$X_1 = ax_{ne}y_{ne} + bx_{ne} + cy_{ne} + d$$

$$Y_0 = ex_{ne}y_{ne} + fx_{ne} + gy_{ne} + h$$

$$X_0 = ax_{sw}y_{sw} + bx_{sw} + cy_{sw} + d$$

$$Y_1 = ex_{sw}y_{sw} + fx_{sw} + gy_{sw} + h$$

$$X_1 = ax_{se}y_{se} + bx_{se} + cy_{se} + d$$

$$Y_1 = ex_{se}y_{se} + fx_{se} + gy_{se} + h.$$

22. A coordinates correction method for controlling the coordinates correction apparatus, comprising the steps of:

receiving coordinates of locations arbitrarily pointed to on a coordinates input area;

keeping quadratic nonlinear conversion constants as coordinates correction parameters; and

correcting the coordinates received in the coordinates receiving step by quadratic nonlinear conversion using the coordinates correction parameters kept in the parameter keeping step.

23. The coordinates correction method of Claim 22, wherein the coordinates correction parameters in said parameter keeping step are a, b, c, d, e, f, g, and h, and the quadratic nonlinear conversion for correcting the coordinates (x, y) received from the coordinates reception means to the corrected

~~coordinates (X, Y) in said coordinates correction step~~
is represented by

$$X = axy + bx + cy + d$$
$$Y = exy + fx + gy + h.$$

24.   The coordinates correction method of Claim
22, further comprising an indication step of indicating
the coordinates on the coordinates input area.

25.   The coordinates correction method of Claim
22, further comprising a coordinates output step of
outputting the coordinates corrected in the coordinates
correction step.

26.   The coordinates correction method of Claim
22, further comprising a parameter calculation step of
calculating the coordinates correction parameters for
nonlinear conversion and causing the coordinates
correction parameters to be kept by the parameter
keeping means.

27.   The coordinates correction method of Claim
26, wherein the coordinates correction parameters are
calculated in based on the coordinates of locations
pointed to with aiming at multiple reference points set
on the coordinates input area.

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28. ~~The coordinates correction method of Claim~~ 27, wherein the parameter calculation step further comprises a discrimination step of determining which of the multiple reference points corresponds to the

5   coordinates of an pointed location.

29.   The coordinates correction method of Claim 27, wherein coordinates correction parameters are calculated in the parameter calculation step by solving

10   simultaneous equations based on the indicated coordinates corresponding to the multiple reference points.

30.   The coordinates correction method of Claim

15   27, wherein the multiple reference points are displayed by a liquid crystal display.

31.   The coordinates correction method of Claim 27, wherein four designated coordinates expressed in

20   pairs of two x coordinates and two y coordinates are used as the multiple reference points in the case that on the coordinates input area is expressed in an xy rectangular coordinates system.

25   32.   The coordinates correction method of Claim 31, wherein coordinates correction parameters, a, b, c, d, e, f, g, and h, are calculated in the parameter

calculation step by solving the following formulas

where the coordinates of the four reference points as (X_0, Y_0), (X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates of the pointed locations with aiming at points as (x_{nw}, y_{nw}), (x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, y_{se}):

$$X_0 = ax_{nw}y_{nw} + bx_{nw} + cy_{nw} + d$$
$$Y_0 = ex_{nw}y_{nw} + fx_{nw} + gy_{nw} + h$$
$$X_1 = ax_{ne}y_{ne} + bx_{ne} + cy_{ne} + d$$
$$Y_0 = ex_{ne}y_{ne} + fx_{ne} + gy_{ne} + h$$
$$X_0 = ax_{sw}y_{sw} + bx_{sw} + cy_{sw} + d$$
$$Y_1 = ex_{sw}y_{sw} + fx_{sw} + gy_{sw} + h$$
$$X_1 = ax_{se}y_{se} + bx_{se} + cy_{se} + d$$
$$Y_1 = ex_{se}y_{se} + fx_{se} + gy_{se} + h;$$

the coordinates correction parameters are kept in the parameter keeping step; and

the coordinates (x, y) received in the coordinates reception step are corrected to corrected coordinates (X, Y) in the coordinates correction steps by the quadratic nonlinear conversion:

$$X = axy + bx + cy + d$$
$$Y = exy + fx + gy + h.$$

33. The coordinates correction method of Claim 26, further comprising a switching step of causing the correction of coordinates by the coordinates correction step if coordinates correction parameters are kept by the parameter keeping step or causing the calculation

of coordinates correction parameters by the parameter
calculation step if coordinates correction parameters
are not held by the parameter keeping step when the
coordinates reception step receives indicated

5   coordinates.

34.   The coordinates correction method of Claims
22 to 33 which is a coordinates correction method for
controlling a portable information processing

10   apparatus.

35.   A coordinates correction parameter
calculation method for calculating coordinates
correction parameters for coordinates correction of

15   locations arbitrarily pointed to on a coordinates input
area included in a coordinates input apparatus by
nonlinear conversion, comprising:
     a coordinates reception step of receiving from the
coordinates input apparatus the coordinates of

20   indicated locations corresponding to multiple
reference points with differing locations established
on the coordinates input area; and
     a parameter calculation step of calculating the
coordinates correction parameters of nonlinear

25   equations for coordinates correction by solving
simultaneous equations by applying the coordinates
received by the coordinates reception step to the

coordinates correction nonlinear equations.

36. The coordinates correction parameter
calculation method of Claim 35, further comprising a
parameter output step for outputting the coordinates
correction parameters calculated in the parameter
calculation step to an external device.

37. The coordinates correction parameter
calculation method of Claim 36, wherein the coordinates
correction parameters calculated in the parameter
calculation step are written in the parameter output
step onto a memory medium.

38. The coordinates correction parameter
calculation method of Claim 37, wherein the coordinates
correction parameters calculated in the parameter
calculation step are written in the parameter output
step onto a ROM.

39. The coordinates correction parameter
calculation method of Claim 35, wherein the parameter
calculation step further comprises a discrimination
step of discriminating which of the multiple reference
points corresponds to the coordinates of an pointed
location.

40. The coordinates correction parameter calculation method of Claim 35, wherein four designated coordinates expressed in pairs of two x coordinates and two y coordinates are used as the multiple reference

5   points in the case that the coordinate input area is expressed in an xy rectangular coordinates system.

41. The coordinates correction parameter calculation method of Claim 40, wherein the parameter

10   calculation means calculates the coordinates correction parameters a, b, c, d, e, f, g, and h, when the nonlinear equations for coordinates correction for correcting the coordinates (x, y) received from the coordinates reception means to the corrected

15   coordinates (X, Y) are expressed by the quadratic nonlinear equations represented by

$$X = axy + bx + cy + d$$
$$Y = exy + fx + gy + h,$$

by solving the following formulas where the coordinates

20   of the four reference points as (X_0, Y_0), (X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates of the pointed locations with aiming at points as (x_{nw}, y_{nw}), (x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, y_{se}):

$$X_0 = ax_{nw}y_{nw} + bx_{nw} + cy_{nw} + d$$

25   $$Y_0 = ex_{nw}y_{nw} + fx_{nw} + gy_{nw} + h$$

$$X_1 = ax_{ne}y_{ne} + bx_{ne} + cy_{ne} + d$$

$$Y_0 = ex_{ne}y_{ne} + fx_{ne} + gy_{ne} + h$$

$$X_0 = ax_{sw}y_{sw} + bx_{sw} + cy_{sw} + d$$

$$Y_1 = ex_{sw}y_{sw} + fx_{sw} + gy_{sw} + h$$

$$X_1 = ax_{se}y_{se} + bx_{se} + cy_{se} + d$$

$$Y_1 = ex_{se}y_{se} + fx_{se} + gy_{se} + h.$$

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42. A computer readable memory medium for storing a coordinates correction control program for controlling a coordinates correction apparatus comprising the steps of:

10   receiving coordinates of locations arbitrarily pointed to in a coordinates input area;

keeping quadratic nonlinear conversion constants as coordinates correction parameters; and

correcting the coordinates received in the

15 coordinates reception step by quadratic nonlinear conversion using coordinates correction parameters kept by the parameter keeping means.

43. The computer readable memory medium of Claim

20 42, wherein the coordinates correction parameters in the parameter keeping step are a, b, c, d, e, f, g, and h and the quadratic nonlinear conversion for correcting the coordinates (x, y) received from the coordinates reception step to the corrected coordinates (X,Y) in the

25 coordinates correction step is represented by

$$X = axy + bx + cy + d$$

$$Y = exy + fx + gy + h.$$

44. The computer readable memory medium for storing a coordinates correction control program of Claim 42, further comprising an indication step of point coordinates in the coordinates input area.

5

45. The computer readable memory medium for storing a coordinates correction control program of Claim 42, further comprising a coordinates output step of outputting coordinates corrected in the coordinates

10 correction step.

46. The computer readable memory medium for storing a coordinates correction control program of Claim 42, further comprising a parameter calculation

15 step of calculating the coordinates correction parameters for nonlinear conversion and causing the coordinates correction parameters to be kept by the parameter keeping means.

20 47. The computer readable memory medium for storing a coordinates correction control program of Claim 46, wherein the coordinates correction parameters are calculated in the parameter calculation step based on the coordinates of locations pointed to with aiming

25 at multiple reference points set on the coordinates input area.

48. The computer readable memory medium for storing a coordinates correction control program of Claim 47, wherein the parameter calculation step further comprises a discrimination step of determining

5   which of the multiple reference points corresponds to the coordinates of an pointed location.

49. The memory medium that can be read by a computer storing a coordinates correction control

10   program of Claim 47, wherein coordinates correction parameters are calculated in the parameter calculation step by solving simultaneous equations based on the indicated coordinates corresponding to the multiple reference points.

15

50. The memory medium that can be read by a computer storing a coordinates correction control program of Claim 47, wherein the multiple reference points are displayed by a liquid crystal display.

20

51. The memory medium that can be read by a computer storing a coordinates correction control program of Claim 47, wherein four designated coordinates expressed in pairs of two x coordinates and

25   two y coordinates are used as the multiple reference points in the case that on the coordinates input area is ~~expressed in an xy rectangular coordinates~~ system.

52. The memory medium that can be read by a computer storing a coordinates correction control program of Claim 51, wherein the coordinates correction parameters are calculated in the parameter calculation step, a, b, c, d, e, f, g, and h, by solving the following formulas where the coordinates of the four reference points as (X_0, Y_0), (X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates of the indicated locations corresponding to these as (x_{nw}, y_{nw}), (x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, y_{se}):

$$X_0 = ax_{nw}y_{nw} + bx_{nw} + cy_{nw} + d$$

$$Y_0 = ex_{nw}y_{nw} + fx_{nw} + gy_{nw} + h$$

$$X_1 = ax_{ne}y_{ne} + bx_{ne} + cy_{ne} + d$$

$$Y_0 = ex_{ne}y_{ne} + fx_{ne} + gy_{ne} + h$$

$$X_0 = ax_{sw}y_{sw} + bx_{sw} + cy_{sw} + d$$

$$Y_1 = ex_{sw}y_{sw} + fx_{sw} + gy_{sw} + h$$

$$X_1 = ax_{se}y_{se} + bx_{se} + cy_{se} + d$$

$$Y_1 = ex_{se}y_{se} + fx_{se} + gy_{se} + h$$

the coordinates correction parameters are kept in the parameter keeping step; and

the coordinates (x, y) received from the coordinates reception step are corrected to corrected coordinates (X, Y) in the coordinates correction steps corrects by the quadratic nonlinear conversion:

$$X = axy + bx + cy + d$$

$$Y = exy + fx + gy + h.$$

53. The computer readable memory medium for
storing a coordinates correction control program of
Claim 56, further comprising a switching step of
causing the correction of coordinates by the

5 coordinates correction step if coordinates correction
parameters are kept by the parameter keeping step or
causing the calculation of coordinates correction
parameters by the parameter calculation step if
coordinates correction parameters are not held by the

10 parameter keeping step when the coordinates reception
step receives indicated coordinates.

54. The computer readable memory medium for
storing a coordinates correction control program of

15 Claims 42 to 53, which is a coordinates correction
program for controlling a portable information
processing apparatus.

55. A computer readable memory medium for storing

20 a coordinates correction parameter calculation program
for calculating coordinates correction parameters for
coordinates correction of locations arbitrarily pointed
to on a coordinates input area of a coordinates input
apparatus by nonlinear conversion, comprising:

25 a coordinates reception step of receiving from the
coordinates input apparatus the coordinates of
indicated locations corresponding to multiple

reference points with differing locations established
on the coordinates input area; and

a parameter calculation step of calculating the
coordinates correction parameters of nonlinear

5 equations for coordinates correction by solving
simultaneous equations by applying the coordinates
received by the coordinates reception step to the
coordinates correction nonlinear equations.

10 56. The memory medium that can be read by a
computer storing a coordinates correction parameter
calculation program of Claim 55 further comprising a
parameter output step for outputting the coordinates
correction parameters calculated by the parameter

15 calculation step to an external device.

57. The memory medium that can be read by a
computer storing a coordinates correction parameter
calculation program of Claim 56, wherein the

20 coordinates correction parameters calculated in the
parameter calculation step are written in the parameter
output step onto a memory medium.

58. The memory medium that can be read by a

25 computer storing a coordinates correction parameter
calculation program of Claim 57, wherein the
coordinates correction parameters calculated in the

parameter calculation step are written in the parameter
output step onto a ROM.

59. The memory medium that can be read by a
computer storing a coordinates correction parameter
calculation program of Claim 55, wherein the parameter
calculation step further comprises a discrimination
step of discriminating which of the multiple reference
points corresponds to the coordinates of an pointed
location.

60. The memory medium that can be read by a
computer storing a coordinates correction parameter
calculation program of Claim 55, wherein four
designated coordinates expressed in pairs of two x
coordinates and two y coordinates are used as the
multiple reference points in the case that on the
coordinate input area is expressed in an xy rectangular
coordinates system.

61. The memory medium that can be read by a
computer storing a coordinates correction parameter
calculation program of Claim 60, wherein the parameter
calculation means calculates the coordinates correction
parameters a, b, c, d, e, f, g, and h, when the
nonlinear equations for coordinates correction for
correcting the coordinates (x, y) received from the

coordinates reception means to the corrected

coordinates (X, Y) are expressed by the quadratic

nonlinear equations represented by

$$X = axy + bx + cy + d$$

5            $$Y = exy + fx + gy + h$$

,by solving the following formulas where the

coordinates of the four reference points as (X_0, Y_0),

(X_1, Y_0), (X_0, Y_1), and (X_1, Y_1), setting the coordinates

of the pointed locations with aiming at points as $(x_{nw},$

10   $y_{nw})$, (x_{ne}, y_{ne}), (x_{sw}, y_{sw}), and (x_{se}, Y_{se});

$$X_0 = ax_{nw}Y_{nw} + bx_{nw} + cy_{nw} + d$$

$$Y_0 = ex_{nw}Y_{nw} + fx_{nw} + gy_{nw} + h$$

$$X_1 = ax_{ne}Y_{ne} + bx_{ne} + cy_{ne} + d$$

$$Y_0 = ex_{ne}Y_{ne} + fx_{ne} + gy_{ne} + h$$

15   $$X_0 = ax_{sw}Y_{sw} + bx_{sw} + cy_{sw} + d$$

$$Y_1 = ex_{sw}Y_{sw} + fx_{sw} + gy_{sw} + h$$

$$X_1 = ax_{se}Y_{se} + bx_{se} + cy_{se} + d$$

$$Y_1 = ex_{se}Y_{se} + fx_{se} + gy_{se} + h.$$

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